

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

POLAROID CORPORATION,
Plaintiff and Counterclaim Defendant,
v.
HEWLETT-PACKARD COMPANY,
Defendants and Counterclaim Plaintiff.

C.A. No. 06-738-SLR

**DECLARATION OF WILLIAM J. MARSDEN, JR.
IN SUPPORT OF DEFENDANT HEWLETT-PACKARD'S
RESPONSIVE CLAIM CONSTRUCTION BRIEF**

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Dated: January 25, 2008

I, William J. Marsden, Jr., declare as follows:

1. I am an attorney with Fish & Richardson P.C., counsel for Defendant Hewlett-Packard Co. I am a member of the Bar of the State of Delaware and of this Court. I have personal knowledge of the matters stated in this declaration and would testify truthfully to them if called upon to do so.

2. Attached hereto as Exhibit A is a true and correct copy of excerpts from Zalman Usiskin, Cathy Hynes Feldman, Suzanne Davis, Sharon Mallo, Gladys Sanders, David Witonsky, James Flander, Lydia Polonsky, Susan Porter, and Steven S. Viktora, Transition Mathematics (2d ed. 1998).

3. Attached hereto as Exhibit B is a true and correct copy of McGraw-Hill Dictionary of Scientific and Technical Term (4th ed., 1989).

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

Executed this 25th of January, 2008 at Wilmington, Delaware.

/s/ William J. Marsden, Jr.
William J. Marsden, Jr.

CERTIFICATE OF SERVICE

I hereby certify that on January 25, 2008, I electronically filed with the Clerk of Court the foregoing **DECLARATION OF WILLIAM J. MARSDEN, JR. IN SUPPORT OF DEFENDANT HEWLETT-PACKARD'S RESPONSIVE CLAIM CONSTRUCTION BRIEF** using CM/ECF which will send electronic notification of such filing(s) to the following counsel::

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Exhibit A



The University of Chicago School Mathematics Project

Transition Mathematics

Second Edition



About the Cover The art on the cover was generated by a computer. The three interlocking rings signify the major themes of this book—algebra, geometry, and applied arithmetic.

Authors

Zalman Usiskin Cathy Hynes Feldman
Suzanne Davis Sharon Mallo Gladys Sanders David Witonsky
James Flanders Lydia Polonsky Susan Porter Steven S. Viktora



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In 6–8, simplify. Show your work.

6. $3[2 + 4(5 - 2)]$

7. $39 - [20 \div 4 + 2(3 + 6)]$

8. $[(3 - 1)^3 + (5 - 1)^4]^2$

9. a. Write a key sequence for evaluating the expression of Question 6 on your calculator.

b. Which do you think is the better method for Question 6: paper and pencil, or calculator? Explain your choice.

10. *Multiple choice.* Written on one line, $\frac{20 + 2 \cdot 30}{6 + 4} =$

(a) $20 + 2 \cdot 30/6 + 4$.

(b) $20 + 2 \cdot 30/(6 + 4)$.

(c) $(20 + 2 \cdot 30)/6 + 4$.

(d) $(20 + 2 \cdot 30)/(6 + 4)$.

In 11 and 12, simplify. Show each step.

11. $\frac{50 + 40}{50 - 40}$

12. $\frac{560}{7(6 + 3 \cdot 4.5)}$

13. a. Write a key sequence for evaluating Question 12 on your calculator.

b. Which do you think is the better method for doing Question 12: paper and pencil, or calculator?

In 14 and 15, evaluate when $a = 5$ and $x = 4$. Show each step.

14. $\frac{a + 3x}{a + x}$

15. $\frac{5x - 2}{(x - 1)(x - 2)}$

Applying the Mathematics

In 16–19, recall that the **mean** or **average** of a collection of numbers is their sum divided by the number of numbers in the collection.

16. Write an expression for the mean of a , b , c , d , and e .

17. A bookcase has three shelves with 42, 37, and 28 books on them. What is the average number of books on a shelf of this bookcase?

18. A student scores 83, 91, 86, and 89 on 4 tests. What is the average?

19. Grades can range from 0 to 100 on tests. A student scores 85 and 90 on the first two tests.

a. What is the lowest the student can average for all 3 tests?

b. What is the highest the student can average for the 3 tests?

In 20 and 21, show each step in evaluating the expression.

20. $5[x + 2y(3 + 2z)]$ when $x = 1$, $y = 2$, and $z = 3$

21. $\frac{x + 3y}{z} + \frac{4y + z}{3x}$ when $x = 3$, $y = 2$, and $z = 1$

In 22 and 23, insert grouping symbols to make the equation true.

22. $3 + 5 \cdot 6 - 8 \cdot 2 = 80$

23. $3 \cdot 8 - 6/2 + 3 = 12$

24. Write the algebraic expression of Example 4 on one line.

LESSON

11-4

*Division
with
Negative
Numbers*

A negative cash flow. Although a person may spend only 50 cents to play a video game, Americans spend \$5 billion a year playing arcade video games.

Dividing a Negative Number by a Positive Number

A person spends 10 dollars in a video arcade in 2 hours. What is the rate? The answer is given by division.

$$\frac{\text{spend 10 dollars}}{2 \text{ hours}} = \text{spend 5 dollars per hour}$$

You can translate the dollars spent into a negative number.

$$\frac{-10 \text{ dollars}}{2 \text{ hours}} = -5 \frac{\text{dollars}}{\text{hour}}$$

This situation is an instance of the division $\frac{-10}{2} = -5$. Another way to do the division is to think as follows: Dividing by 2 is the same as multiplying by its reciprocal, $\frac{1}{2}$.

$$\frac{-10}{2} = -10 \cdot \frac{1}{2} = -5$$

In general, if a negative number is divided by a positive number, the quotient is negative.

Example 1

On five consecutive days, the low temperatures in a city were 3°C , -4°C , -6°C , -2°C , and 0°C . What was the mean low temperature for the five days?

Solution

Recall that the mean (or average) temperature is found by adding up the numbers and dividing by 5.

$$\frac{3 + -4 + -6 + -2 + 0}{5} = \frac{-9}{5} = -1.8$$

The mean low temperature was -1.8°C , or about -2°C . This temperature is a little below freezing.

Exhibit B

A
B

McGraw-Hill DICTIONARY OF SCIENTIFIC AND TECHNICAL TERMS

Fourth Edition



Sybil P. Parker

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On the cover: Pattern produced from white light by a computer-generated diffraction plate containing 529 square apertures arranged in a 23 x 23 array. (R. B. Hoover, Marshall Space Flight Center)

On the title pages: Aerial photograph of the Sinai Peninsula made by Gemini spacecraft. (NASA)

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chrematophobia [PSYCH] An abnormal fear of money. { krə'mad-ə'fō-bē-ə }

Christiansen effect [ANALY CHEM] Monochromatic transparency effect when finely powdered substances, such as glass or quartz, are immersed in a liquid having the same refractive index. { 'krɪs-θən-sən ī-fekt }

Christiansen filter [OPTICS] A type of color filter, a solid-in-liquid suspension, which scatters all incident energy except that of a narrow frequency range out of the direct beam. Also known as band-pass filter. { 'krɪs-θən-sən 'fil-tər }

Christmas disease [MED] A hereditary, sex-linked, hemophilia-like disease involving failure of the clotting mechanism due to a deficiency of Christmas factor. { 'krɪs-məs di-zēz }

Christmas factor [BIOCHEM] A soluble protein blood factor involved in blood coagulation. Also known as factor IX; plasma thromboplastin component (PTC). { 'krɪs-məs ,fak-tər }

Christmas tree [PETRO ENG] An assembly of valves, tees, crosses, and other fittings at the wellhead, used to control oil or gas production and to give access to the well tubing. { 'krɪs-məs ,trē }

Christoffel symbols [MATH] Symbols which represent particular functions of the coefficients and their first-order derivatives of a quadratic form. { 'krɪs-tōf-əl ,sɪm-bəlz }

christophite See marmatite. { 'krɪs-tə-fit }

chroma [OPTICS] 1. The dimension of the Munsell system of color that corresponds most closely to saturation, which is the degree of vividness of a hue. Also known as Munsell chroma. 2. See color saturation. { 'krō-mə }

chroma band-pass amplifier See burst amplifier. { 'krō-mə 'band-pas 'am-plif-ər }

chroma control [ELECTR] The control that adjusts the amplitude of the carrier chrominance signal fed to the chrominance demodulators in a color television receiver, so as to change the saturation or vividness of the hues in the color picture. Also known as color control; color-saturation control. { 'krō-mə kən-tro'l }

chromadizing [MET] Treating the surface of aluminum or aluminum alloys with chromic acid to improve paint adhesion. { 'krō-mə,diz-ɪŋ }

Chromadora [INV ZOO] A subclass of nematode worms in the class Adenophorea. { 'krō-mə'dōrē-ə }

Chromadorida [INV ZOO] An order of principally aquatic nematode worms in the subclass Chromadaria. { 'krō-mə'dōr-ē-də }

Chromadoridae [INV ZOO] A family of soil and fresh-water, free-living nematodes in the superfamily Chromadoroidea; generally associated with algal substances. { 'krō-mə'dōr-ō-dē }

Chromadoroidea [INV ZOO] A superfamily of small to moderate-sized, free-living nematodes with spiral, transversely ellipsoidal amphids and a striated cuticle. { 'krō-mə-dōrō-ē-də }

chromaffin [BIOL] Staining with chromium salts. { krō'ma-fən }

chromaffin body See paraganglion. { krō'ma-fən ,bād-ē }

chromaffin cell [HISTOL] Any cell of the suprarenal organs in lower vertebrates, of the adrenal medulla in mammals, of the paranglia, or of the carotid bodies that stains with chromium salts. { krō'ma-fən ,sel }

chromaffin system [PHYSIO] The endocrine organs and tissues of the body that secrete epinephrine; characterized by an affinity for chromium salts. { krō'ma-fən ,sɪs-təm }

chroma oscillator [ELECTR] A crystal oscillator used in color television receivers to generate a 3.579545-megahertz signal for comparison with the incoming 3.579545-megahertz chrominance subcarrier signal being transmitted. Also known as chrominance-subcarrier oscillator; color oscillator; color-subcarrier oscillator. { 'krō-mə 'ās-ə,lād-ər }

chromascope [OPTICS] An instrument used to determine the optical effects of color. { 'krō-mə,skōp }

chromate [INORG CHEM] CrO_4^{2-} 1. An ion derived from the unstable acid H_2CrO_4 . 2. A salt or ester of chromic acid. { MINERAL } A mineral characterized by the cation CrO_4^{2-} { 'krō-māt }

chromate treatment [MET] Treatment of metal with a solution of a hexavalent chromium compound to produce a protective coating of metal chromate. { 'krō-māt,tri-tē-mənt }

Chromatiaceae [MICROBIO] A family of bacteria in the suborder Rhodospirillineae; motile cells have polar flagella, photo-

synthetic membranes are continuous with the cytoplasmic membrane, all except one species are anaerobic, and bacteriochlorophyll *a* or *b* is present. { 'krō-māt-ē-as-ē,ī }

chromatic [OPTICS] Relating to color. { krō'mad-ik }

chromatic aberration [ELECTR] An electron-gun defect causing enlargement and blurring of the spot on the screen of a cathode-ray tube, because electrons leave the cathode with different initial velocities and are deflected differently by the electron lenses and deflection coils. [OPTICS] An optical lens defect causing color fringes, because the lens material brings different colors of light to focus at different points. Also known as color aberration. { krō'mad-ik ab-ə-rā-shən }

chromatic diagram See chromaticity diagram. { krō'mad-ik 'dī-ə,gram }

chromaticity [OPTICS] The color quality of light that can be defined by its chromaticity coordinates; depends only on hue and saturation of a color, and not on its luminance (brightness). { 'krō-mā-tis-əd-ē }

chromaticity coordinates [OPTICS] The fractional amounts of the *x*, *y*, and *z* primary colors, specified by the International Committee on Illumination, in a color sample; more precisely, $x = X / (X + Y + Z)$, $y = Y / (X + Y + Z)$, $z = Z / (X + Y + Z)$, where *X*, *Y*, and *Z* are the integrals over wavelength λ of the product of the amount of light emerging from the sample per unit wavelength, and the tristimulus values, $X(\lambda)$, $Y(\lambda)$, and $Z(\lambda)$ respectively. { 'krō-mā-tis-əd-ē kō'ōrd-ən-āt̄s }

chromaticity diagram [OPTICS] A triangular graph for specifying colors, whose ordinate is the *y* chromaticity coordinate and whose abscissa is the *x* chromaticity coordinate; the apexes of the triangle represent primary colors. Also known as chromatic diagram. { 'krō-mā-tis-əd-ē dī-ə,gram }

chromatic mineral [MINERAL] A mineral with color. { krō'mad-ik ,min-ral }

chromatic number [MATH] For a specified surface, the smallest number *n* such that for any decomposition of the surface into regions the regions can be colored with *n* colors in such a way that no two adjacent regions have the same color. { krō'mad-ik 'nām-bər }

chromatic parallax [OPTICS] A type of optical parallax that arises from the dependence of the position of the focal plane on the wavelength of light. { krō'mad-ik 'par-ə,laks }

chromatic resolving power [OPTICS] The difference between two equally strong spectral lines that can barely be separated by a spectroscopic instrument, divided into the average wavelength of these two lines; for prisms and gratings Rayleigh's criteria are used, and the term is defined as the width of the emergent beam times the angular dispersion. { krō'mad-ik rā'zāl-ē-ēg ,pā'ūr }

chromatics [OPTICS] 1. The branch of optics concerned with the properties of colors. 2. The part of colorimetry concerned with hue and saturation. { krō'mad-iks }

chromatic sensitivity [OPTICS] The smallest change in wavelength of light that produces a change in hue which is just large enough to be detected by human vision. { krō'madik sens'ē-tiv-əd-ē }

chromatic vision [PHYSIO] Vision pertaining to the color sense, that is, the perception and evaluation of the colors of the spectrum. { krō'mad-ik 'vīzh-ən }

chromatid [CYTOL] 1. One of the pair of strands formed by longitudinal splitting of a chromosome which are joined by a single centromere in somatic cells during mitosis. 2. One of a tetrad of strands formed by longitudinal splitting of paired chromosomes during diplotene of meiosis. { 'krō-mā-tid }

chromatin [BIOCHEM] The deoxyribonucleoprotein complex forming the major portion of the nuclear material and of the chromosomes. { 'krō-mā-tān }

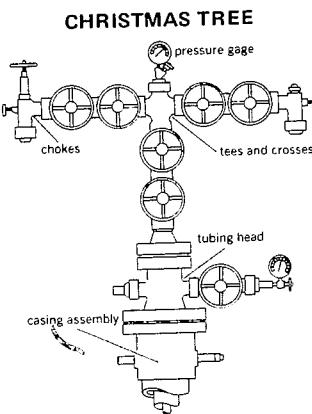
chromating [MET] Performing a chromate treatment. { 'krō-māt-ēn }

Chromatium [MICROBIO] A genus of bacteria in the family Chromatiaceae; cells are ovoid to rod-shaped, are motile, do not have gas vacuoles, and contain bacteriochlorophyll *a* on vesicular photosynthetic membranes. { 'krō-māshē-əm }

chromatogram [ANALY CHEM] The pattern formed by zones of separated pigments and of colorless substance in chromatographic procedures. { krō'mad-ə,gram }

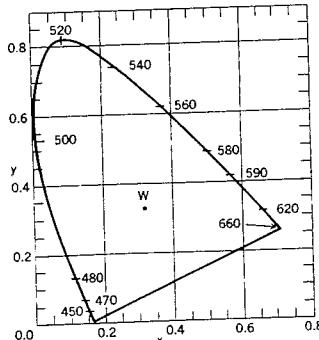
chromatograph [ANALY CHEM] To employ chromatography to separate substances. { krō'mad-ə,grāf }

chromatographic adsorption [ANALY CHEM] Preferential adsorption of chemical compounds (gases or liquids) in an



Typical layout of a Christmas tree.

CHROMATICITY DIAGRAM



International Committee on Illumination chromaticity diagram. The wavelengths of the visible spectrum in units of 10^{-9} meter are indicated along the curve. *W* represents a white composed of equal amounts of the three primaries. (Adapted from A. C. Hardy, ed., *Handbook of Colorimetry*, copyright 1936 by The MIT Press)

chromatography

ascending molecular-weight sequence onto a solid adsorbent material, such as activated carbon, alumina, or silica gel; used for analysis and separation of chemical mixtures. { 'krō-mad-grafik ad-sörp-shən }

chromatography [ANALY CHEM] A method of separating and analyzing mixtures of chemical substances by chromatographic adsorption. { 'krō-mä-täg-rä-fē }

chromatophobia [PSYCH] An abnormal fear of colors. { 'krō-mad-ə-fō-bē-ə }

chromatophore [HISTOL] A type of pigment cell found in the integument and certain deeper tissues of lower animals that contains color granules capable of being dispersed and concentrated. { 'krō-mad-ə-för }

chromatophorotrophin [BIOCHEM] Any crustacean neurohormone which controls the movement of pigment granules within chromatophores. { 'krō-mad-ə-för-ə-trō-fēn }

chromatoplasm [BOT] The peripheral protoplasm in blue-green algae containing chlorophyll, accessory pigments, and stored materials. { 'krō'mad-ə-plaz-əm }

chromatopsia [MED] A disorder of visual sensation in which color impressions are disturbed or arise subjectively, with objects appearing as unnaturally colored or colorless objects as colored; may be caused by a disturbance of the optic centers, psychic disturbance, or drugs. { 'krō-mä-täp-sē-ə }

chromatoscope [OPTICS] An instrument in which light beams are used to mix color stimuli. { 'krō-mad-ə,skōp }

chromatosis [MED] A pathologic process or pigmentary disease in which there is a deposit of coloring matter in a normally unpigmented site, or an excessive deposit in a normally pigmented area. { 'krō-mä-tō-səs }

chromatron [ELECTR] A single-gun color picture tube having color phosphors deposited on the screen in strips instead of dots. Also known as Lawrence tube. { 'krō-mä-trän }

chrome alum [INORG CHEM] $KCr(SO_4)_2 \cdot 12H_2O$ An alum obtained as purple crystals and used as a mordant, in tanning, and in photography in the fixing bath. Also known as potassium chromium sulfate. { 'krōm'al-əm }

chrome brick See chrome refractory. { 'krōm,brik }

chrome diopside [MINERAL] A bright green variety of diopside containing a small amount of Cr_2O_3 . { 'krōm'di-äp,sid }

chrome dye [CHEM] One of a class of acid dyes used on wool with a chromium compound as mordant. { 'krōm'di }

chrome green See chromic oxide. { 'krōm,grēn }

chrome iron ore See chromite. { 'krōm'i-rän,ör }

chrome leather [MATER] A leather tanned with chromium salts and used in making shoe uppers. { 'krōm'lēth-ər }

chrome plating [MET] A thin plate of chromium deposited by electrolysis on a corrodible metal, giving a bright, metallic surface which is highly resistant to tarnish; used to coat automobile trimming, bathroom fixtures, and many household and other articles. Also known as chromium coating; chromium plating. { 'krōm'pläd-ing }

chrome red [CHEM] 1. A pigment containing basic lead chromate. 2. Any of several mordant acid dyes. { 'krōm'red }

chrome refractory [MATER] A ceramic material made from chrome ore and used to line steel furnaces. Also known as chrome brick. { 'krōm'rifik-trē }

chrome spinel See picotite. { 'krōm'spə-nēl }

chrome steel See chromium steel. { 'krōm'stēl }

chrome tanning [CHEM ENG] Tanning treatment of animal skin with chromium salts. { 'krōm'tan-ij }

chrome-vanadium steel See chromium-vanadium steel. { 'krōm've,nād-ēm'stēl }

chrome yellow [CHEM] 1. A yellow pigment composed of normal lead chromate, $PbCrO_4$, or other lead compounds. 2. Any of several mordant acid dyes. { 'krōm'yel-ō }

chromic acid [INORG CHEM] H_2CrO_4 . The hydrate of CrO_3 ; exists only as salts or in solution. { 'krō-mik'as-əd }

chromic chloride [INORG CHEM] $CrCl_3$. Crystals that are pinkish violet shimmering plates, almost insoluble in water, but easily soluble in presence of minute traces of chromous chloride; used in calico printing, as a mordant for cotton and silk. { 'krō-mik'klör-id }

chromic fluoride [INORG CHEM] $CrF_3 \cdot 4H_2O$ Crystals that are green, soluble in water; used in dyeing cottons. { 'krō-mik'flür,id }

chromic hydroxide [INORG CHEM] $Cr(OH)_3 \cdot 2H_2O$ Gray-green, gelatinous precipitate formed when a base is added to a chromic salt; the precipitate dries to a bluish, amorphous pow-

der; prepared as an intermediate in the manufacture of other soluble chromium salts. { 'krō-mik hī'dräk,sid }

chromic nitrate [INORG CHEM] $Cr(NO_3)_3 \cdot 9H_2O$ Purple, rhombic crystals that are soluble in water; used as a mordant in textile dyeing. { 'krō-mik'nī,trät }

chromic oxide [INORG CHEM] Cr_2O_3 . A dark green, amorphous powder, forming hexagonal crystals on heating that are insoluble in water or acids; used as a pigment to color glass and ceramic ware and as a catalyst. Also known as chrome green. { 'krō-mik'äk,sid }

chrominance [OPTICS] The difference between any color and a specified reference color of equal brightness; in color television, this reference color is white having coordinates $x = 0.310$ and $y = 0.316$ on the chromaticity diagram. { 'krō-mä-näns }

chrominance carrier See chrominance subcarrier. { 'krō-mä-näns,kär-ē-ər }

chrominance-carrier reference [COMMUN] A continuous signal having the same frequency as the chrominance subcarrier in a color television system and having fixed phase with respect to the color burst; this signal is the reference with which the phase of a chrominance signal is compared for the purpose of modulation or demodulation. Also known as chrominance-subcarrier reference; color-carrier reference; color-subcarrier reference. { 'krō-mä-näns,kär-ē-ər,ref-räns }

chrominance channel [COMMUN] Any path that is intended to carry the chrominance signal in a color television system. { 'krō-mä-näns,chan-əl }

chrominance demodulator [ELECTR] A demodulator used in a color television receiver for deriving the I and Q components of the chrominance signal from the chrominance signal and the chrominance-subcarrier frequency. Also known as chrominance-subcarrier demodulator. { 'krō-mä-näns,dē-mäj-ə-läd-ər }

chrominance frequency [COMMUN] The frequency of the chrominance subcarrier, equal to 3.579545 megahertz. { 'krō-mä-näns,fré-kwän-sē }

chrominance gain control [ELECTR] Variable resistors in red, green, and blue matrix channels that individually adjust primary signal levels in color television. { 'krō-mä-näns,gän-kän'trōl }

chrominance modulator [ELECTR] A modulator used in a color television transmitter to generate the chrominance signal from the video-frequency chrominance components and the chrominance subcarrier. Also known as chrominance-subcarrier modulator. { 'krō-mä-näns,mäj-ə-läd-ər }

chrominance primary [COMMUN] The nonphysical color represented by either the I or Q chrominance signal component in a color television system. { 'krō-mä-näns,pri,mer-ē }

chrominance signal [COMMUN] One of the two components, called the I signal and Q signal, that add together to produce the total chrominance signal in a color television system. Also known as carrier chrominance signal. { 'krō-mä-näns,sig-näl }

chrominance subcarrier [COMMUN] The 3.579545-megahertz carrier whose modulation sidebands are added to the monochrome signal to convey color information in a color television receiver. Also known as chrominance carrier; color carrier; color subcarrier; subcarrier. { 'krō-mä-näns,səb'kär-ē-ər }

chrominance-subcarrier demodulator See chrominance demodulator. { 'krō-mä-näns,səb'kär-ē-ər,dē-mäj-ə-läd-ər }

chrominance-subcarrier modulator See chrominance modulator. { 'krō-mä-näns,səb'kär-ē-ər,mäj-ə-läd-ər }

chrominance-subcarrier oscillator See chroma oscillator. { 'krō-mä-näns,səb'kär-ē-ər,äs-ə,läd-ər }

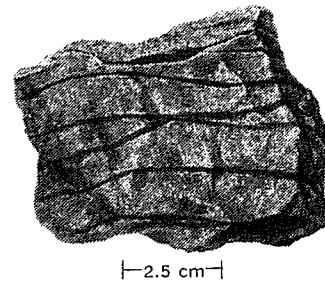
chrominance-subcarrier reference See chrominance-carrier reference. { 'krō-mä-näns,səb'kär-ē-ər,ref-räns }

chrominance-video signal [ELECTR] Voltage output from the red, green, or blue section of a color television camera or receiver matrix. { 'krō-mä-näns,vid-ē-ō,sig-näl }

chromite [MINERAL] $FeCr_2O_4$. A mineral of the spinel group; crystals and pure form are rare, and it usually is massive; the only important ore mineral of chromium. Also known as chrome iron ore. { 'krō,mít }

chromium [CHEM] A metallic chemical element, symbol Cr, atomic number 24, atomic weight 51.996. [MET] A blue-white, hard, brittle metal used in chrome plating, in chromizing, and in many alloys. { 'krō-mē-əm }

CHROMITE



Chromite veins in a peridotite sample found in Selukwe, Rhodesia. (Specimen from Department of Geology, Bryn Mawr College)

CHROMIUM

24	Cr
Transition Elements	
1	H
2	D
3	T
4	Sc
5	Cr
6	Mn
7	Fe
8	Co
9	Ni
10	Zn
11	Ge
12	As
13	Se
14	Br
15	I
16	Te
17	At
18	Rn
19	Fr
20	Ra
21	Cs
22	Fr
23	Sc
24	Cr
25	Mn
26	Fe
27	Co
28	Ni
29	Zn
30	Ge
31	As
32	Se
33	Br
34	I
35	Te
36	At
37	Fr
38	Ra
39	Cs
40	Fr
41	Sc
42	Cr
43	Mn
44	Fe
45	Co
46	Ni
47	Zn
48	Ge
49	As
50	Se
51	Br
52	I
53	Te
54	At
55	Fr
56	Ra
57	Cs
58	Fr
59	Sc
60	Cr
61	Mn
62	Fe
63	Co
64	Ni
65	Zn
66	Ge
67	As
68	Se
69	Br
70	I
71	Te
72	At
73	Fr
74	Ra
75	Cs
76	Fr
77	Sc
78	Cr
79	Mn
80	Fe
81	Co
82	Ni
83	Zn
84	Ge
85	As
86	Se
87	Br
88	I
89	Te
90	At
91	Fr
92	Ra
93	Cs
94	Fr
95	Sc
96	Cr
97	Mn
98	Fe
99	Co
100	Ni
101	Zn
102	Ge
103	As
104	Se
105	Br
106	I
107	Te
108	At
109	Fr
110	Ra
111	Cs
112	Fr
113	Sc
114	Cr
115	Mn
116	Fe
117	Co
118	Ni
119	Zn
120	Ge
121	As
122	Se
123	Br
124	I
125	Te
126	At
127	Fr
128	Ra
129	Cs
130	Fr
131	Sc
132	Cr
133	Mn
134	Fe
135	Co
136	Ni
137	Zn
138	Ge
139	As
140	Se
141	Br
142	I
143	Te
144	At
145	Fr
146	Ra
147	Cs
148	Fr
149	Sc
150	Cr
151	Mn
152	Fe
153	Co
154	Ni
155	Zn
156	Ge
157	As
158	Se
159	Br
160	I
161	Te
162	At
163	Fr
164	Ra
165	Cs
166	Fr
167	Sc
168	Cr
169	Mn
170	Fe
171	Co
172	Ni
173	Zn
174	Ge
175	As
176	Se
177	Br
178	I
179	Te
180	At
181	Fr
182	Ra
183	Cs
184	Fr
185	Sc
186	Cr
187	Mn
188	Fe
189	Co
190	Ni
191	Zn
192	Ge
193	As
194	Se
195	Br
196	I
197	Te
198	At
199	Fr
200	Ra
201	Cs
202	Fr
203	Sc
204	Cr
205	Mn
206	Fe
207	Co
208	Ni
209	Zn
210	Ge
211	As
212	Se
213	Br
214	I
215	Te
216	At
217	Fr
218	Ra
219	Cs
220	Fr
221	Sc
222	Cr
223	Mn
224	Fe
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227	Zn
228	Ge
229	As
230	Se
231	Br
232	I
233	Te
234	At
235	Fr
236	Ra
237	Cs
238	Fr
239	Sc
240	Cr
241	Mn
242	Fe
243	Co
244	Ni
245	Zn
246	Ge
247	As
248	Se
249	Br
250	I
251	Te
252	At
253	Fr
254	Ra
255	Cs
256	Fr
257	Sc
258	Cr
259	Mn
260	Fe
261	Co
262	Ni
263	Zn
264	Ge
265	As
266	Se
267	Br
268	I
269	Te
270	At
271	Fr
272	Ra
273	Cs
274	Fr
275	Sc
276	Cr
277	Mn
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281	Zn
282	Ge
283	As
284	Se
285	Br
286	I
287	Te
288	At
289	Fr
290	Ra
291	Cs
292	Fr
293	Sc
294	Cr
295	Mn
296	Fe
297	Co
298	Ni
299	Zn
300	Ge
301	As
302	Se
303	Br
304	I
305	Te
306	At
307	Fr
308	Ra
309	Cs
310	Fr
311	Sc
312	Cr
313	Mn
314	Fe
315	Co
316	Ni
317	Zn
318	Ge
319	As
320	Se
321	Br
322	I
323	Te
324	At
325	Fr
326	Ra
327	Cs
328	Fr
329	Sc
330	Cr
331	Mn
332	Fe
333	Co
334	Ni
335	Zn
336	Ge
337	As
338	Se
339	Br
340	I
341	Te
342	At
343	Fr
344	Ra
345	Cs
346	Fr
347	Sc
348	Cr
349	Mn
350	Fe
351	Co
352	Ni
353	Zn
354	Ge
355	As
356	Se
357	Br
358	I
359	

chromium-51 [NUC PHYS] A radioactive isotope with atomic mass 51 made by neutron bombardment of chromium; radiates gamma rays. { 'krō-mē-əm, fiftē-'wān }

chromium carbide [INORG CHEM] Cr_3C_2 Orthorhombic crystals with a melting point of 1890°C; resistant to oxidation, acids, and alkalies; used for hot-extrusion dies, in spray-coating materials, and as a component for pumps and valves. { 'krō-mē-əm 'kār,bid }

chromium chloride [INORG CHEM] A group of compounds of chromium and chloride; chromium may be in the +2, +3, or +6 oxidation state. { 'krō-mē-əm 'klōr,īd }

chromium coating See chrome plating. { 'krō-mē-əm 'kōd-ing }

chromium dioxide [INORG CHEM] Cr_2O_3 Black, acicular crystals; a semiconducting material with strong magnetic properties used in recording tapes. { 'krō-mē-əm dī'āk,sid }

chromium dioxide tape [ELECTR] A magnetic recording tape developed primarily to improve quality and brilliance of reproduction when used in cassettes operated at 1/7 inches per second (4.76 centimeters per second); requires special recorders that provide high bias. { 'krō-mē-əm dī'āk,sid 'tāp }

chromium-gold metallizing [ELECTR] A metal film used on a silicon or silicon oxide surface in semiconductor devices because it is not susceptible to purple plague deterioration; a layer of chromium is applied first for adherence to silicon, then a layer of chromium-gold mixture, and finally a layer of gold to which bonding contacts can be applied. { 'krō-mē-əm 'gōld 'med-əl-īz-ing }

chromium-iron alloy [MET] Any of several acid- and corrosion-resistant alloys containing chromium and iron. { 'krō-mē-əm 'īrən 'al,ōi }

chromium-molybdenum steel [MET] Cast steel containing up to 1% carbon, 0.7–1.1% chromium, and 0.2–0.4% molybdenum; characterized by high strength and ductility. { 'krō-mē-əm mō'lib-də-nəm 'stēl }

chromium-nickel alloy [MET] Any of several alloys containing chromium and nickel in various proportions together with small amounts of other metals. { 'krō-mē-əm 'nik-ēl 'al,ōi }

chromium oxide [INORG CHEM] A compound of chromium and oxygen; chromium may be in the +2, +3, or +6 oxidation state. { 'krō-mē-əm 'āk,sid }

chromium oxychloride See chromyl chloride. { 'krō-mē-əm 'āk-sē'klōr,īd }

chromium plating See chrome plating. { 'krō-mē-əm 'plād-ing }

chromium stearate [ORG CHEM] $\text{Cr}(\text{C}_{18}\text{H}_{35}\text{O}_2)_3$ A dark-green powder, melting at 95–100°C; used in greases, ceramics, and plastics. { 'krō-mē-əm 'stir,āt }

chromium steel [MET] Hard, wear-resistant steel containing chromium as the predominating alloying element. Also known as chrome steel. { 'krō-mē-əm 'stēl }

chromium-vanadium steel [MET] Any of several strong, hard alloy steels containing 0.15–0.25% vanadium, 0.50–1% chromium, and 0.45–0.55% carbon. Also known as chrome-vanadium steel. { 'krō-mē-əm 'vā-nādē-əm 'stēl }

chromizing [MET] Surface-alloying of metals in which an alloy is formed by diffusion of chromium into the base metal. { 'krō,mīz-ing }

Chromobacterium [MICROBIO] A genus of gram-negative, aerobic or facultatively anaerobic, motile, rod-shaped bacteria of uncertain affiliation; they produce violet colonies and violacein, a violet pigment with antibiotic properties. { 'krō-mō,bak'tirē-əm }

chromoblastomycosis [MED] A granulomatous skin disease caused by any of several fungi, usually *Hormodendrum pedrosoi*, and characterized by warty nodules which may ulcerate. Also known as chromomycosis. { 'krō-mō,blastō-mī'kōsəs }

chromocenter [CYTOL] An irregular, densely staining mass of heterochromatin in the chromosomes, with six armlike extensions of euchromatin, in the salivary glands of *Drosophila*. { 'krō-mō,sen-tər }

chromocratic See melanocratic. { 'krō-mā,krad-ik }

chromocyte [HISTOL] A pigmented cell. { 'krō-mā,sīt }

chromodynamics [PARTIC PHYS] A theory of the interaction between quarks carrying color in which the quarks exchange gluons in a manner analogous to the exchange of photons

between charged particles in electrodynamics. { 'krō-mō-dī'nām-iks }

chromogen [BIOCHEM] A pigment precursor. [MICROBIO] A microorganism capable of producing color under suitable conditions. { 'krō-mā,jēn }

chromogenesis [BIOCHEM] Production of colored substances as a result of metabolic activity; characteristic of certain bacteria and fungi. { 'krō-mō,jēn-əsēs }

chromolipid See lipochrome. { 'krō-mō'lip-id }

chromolithography [GRAPHICS] Lithographic printing with several colors, requiring a stone for each color. { 'krō-mō-li'thāg-rāfē }

chromomere [CYTOL] Any of the linearly arranged chromatin granules in leptotene and pachytene chromosomes and in polytene nuclei. { 'krō-mō,mir }

chromometer See colorimeter. { 'krā-mām-ēd-ər }

chromomycin [MICROBIO] Any of five components of an antibiotic complex produced by a strain of *Streptomyces griseus*; components are designated A₁ to A₅, of which A₃ ($\text{C}_{51}\text{H}_{72}\text{O}_{32}$) is biologically active. { 'krō-mō'mī-sān }

chromomycosis See chromoblastomycosis. { 'krō-mō'mī-kōsəs }

chromonema [CYTOL] The coiled core of a chromatid; it is thought to contain the genes. { 'krō-mō'nē-mā }

chromoneme [GEN] The genetic material of a bacterium or virus, as distinguished from true chromosomes in plant or animal cells. { 'krō-mā,nēm }

chromophile [BIOL] Staining readily. { 'krō-mō,fil }

chromophobe [BIOL] Not readily absorbing a stain. { 'krō-mā,fōb }

chromophore [CHEM] An arrangement of atoms that gives rise to color in many organic substances. { 'krō-mā,fōr }

Chromophycota [BOT] A division of the plant kingdom comprising nine classes of algae ranging in size and complexity from unicellular flagellates to gigantic kelps; distinguished by the presence (in almost all) of chlorophyll c to complement chlorophyll a, and usually having brownish or yellowish chloroplasts. Also known as Chromophyta. { 'krō-mō'fīkātə }

chromophyll [BIOCHEM] Any plant pigment. { 'krō-mē,fil }

Chromophyta See Chromophycota. { 'krō'māf-ēd-ə }

chromoplasm [BOT] The pigmented, peripheral protoplasm of blue-green algae cells; contains chlorophyll, carotenoids, and phycobilins. { 'krō-mō,plazəm }

chromoplast [CYTOL] Any colored cell plastid, excluding chloroplasts. { 'krō-mō,plast }

chromoprotein [BIOCHEM] Any protein, such as hemoglobin, with a metal-containing pigment. { 'krō-mō'prō'tēn }

chromoradiometer [ENG] A radiation meter that uses a substance whose color changes with x-ray dosage. { 'krō-mō,rād-ē'ām-ēd-ər }

chromoscope [OPTICS] An instrument for analyzing color values and intensities. { 'krō-mā,skōp }

chromosomal hybrid sterility [GEN] Sterility caused by inability of homologous chromosomes to pair during meiosis due to a chromosome aberration. { 'krō-mā,sō'māl 'hī-brēd stērītēd-ē }

chromosome [CYTOL] Any of the complex, threadlike structures seen in animal and plant nuclei during karyokinesis which carry the linearly arranged genetic units. { 'krō-mā,sōm }

chromosome aberration [GEN] Modification of the normal chromosome complement due to deletion, duplication, or rearrangement of genetic material. { 'krō-mā,sōm ab'ər'rāshən }

chromosome complement [GEN] The species-specific, normal diploid set of chromosomes in somatic cells. { 'krō-mā,sōm 'kām'plə,mēnt }

chromosome map See genetic map. { 'krō-mā,sōm'ap }

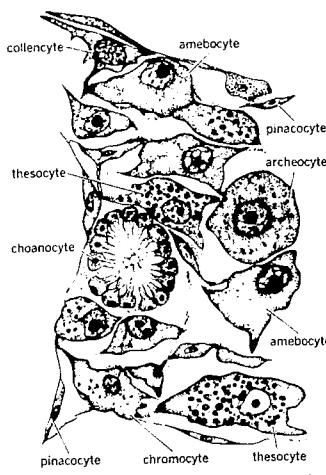
chromosome puff [CYTOL] Chromatic material accumulating at a restricted site on a chromosome; thought to reflect functional activity of the gene at that site during differentiation. { 'krō-mā,sōm,pūf }

chromosome walking [GEN] Sequential isolation of overlapping molecular clones in order to span large intervals on the chromosome. { 'krō-mā,sōm,wok'īn }

chromosphere [ASTRON] A transparent, tenuous layer of gas that rests on the photosphere in the atmosphere of the sun. { 'krō-mā,sfīr }

chromospheric network [ASTRON] A large-scale cellular pattern into which the motion of gas in the chromosphere is ordered by magnetic folds, and which is visible in spectroscopic

CHROMOCYTE



Cell types found in a fresh-water sponge as seen in a cross section through the interior of the sponge. Note chromocyte at bottom of tissue.

low-voltage winding

becomes active; used to activate bugging equipment. { 'lō ,vōltij ,rē,lā }

low-voltage winding [ELECTROMAG] The coil of wire wound around the core of a power transformer which has the smaller number of turns, and therefore the lower voltage. { 'lō ,vōl-tij ,wīnd-ing }

low-water [OCEANOGR] The lowest limit of the surface water level reached by the lowering tide. Also known as low tide. { 'lō ,wōd-ər }

low-water fuel cutoff [MECH ENG] A float device which shuts off fuel supply and burner when boiler water level drops below the lowest safe waterline. { 'lō ,wōd-ər ,fyūl ,kō,dōf }

low-water inequality [OCEANOGR] The difference between the heights of two successive low tides. { 'lō ,wōd-ər ,in-kwāl-əd-ē }

low-water interval See low-water lunital interval. { 'lō ,wōd-ər ,in-tar'väl }

low-water lunital interval [GEOPHYS] For a specific location, the interval of time between the transit (upper or lower) of the moon and the next low water. Also known as low-water interval. { 'lō ,wōd-ər ,lūn-tid-əl ,in-tar'väl }

low-water neaps See mean low-water neaps. { 'lō ,wōd-ər ,neaps }

low-water springs See mean low-water springs. { 'lō ,wōd-ər ,springs }

LOX See liquid-oxygen explosive. { läks }

loxodont [VERT ZOO] Having molar teeth with shallow hollows between the ridges. { 'lāk-sō,dānt }

loxodrome See rhumb line. { 'lāk-sō,drōm }

loxodromic spiral [MATH] A curve on a surface of revolution which cuts the meridians at a constant angle other than 90°. { 'lāk-sō,drāmik ,spīr'əl }

loxolophodont [VERT ZOO] Having crests on the molar teeth that connect three of the tubercles and with the fourth or posterior inner tubercle being rudimentary or absent. { 'lāk-sō,lāf-dānt }

Loxonematacea [PALEON] An extinct superfamily of gastropod mollusks in the order Prosobranchia. { 'lāk-sō,ne-mā'tās-ē-ə }

lozenge file [DES ENG] A small file with four sides and a lozenge-shaped cross section; used in forming dies. { 'lāz-ən,j fil }

L pad [ENG ACOUS] A volume control having essentially the same impedance at all settings. { 'el ,pad }

LPE See liquid-phase epitaxy.

LPF process [MIN ENG] Recovery of metals from tailings by a sequence of leaching, precipitation, and flotation. { 'el,pē'ef ,prāsəs }

LPG See liquefied petroleum gas.

LPM See lines per minute.

LP record See long-playing record. { 'el,pē 'rek-ərd }

l-process [NUC PHYS] The synthesis of certain light nuclides through the breakup of heavier nuclides, probably by cosmic-ray bombardment of the interstellar medium. { 'l ,prāsəs }

LPTV station See low-power television station. { 'el,pē,te've ,stāshən }

Lr See lawrencium.

LRC See longitudinal redundancy check.

LRRP See lowest required radiating power.

LSA diode [ELECTR] A microwave diode in which a space charge is developed in the semiconductor by the applied electric field and is dissipated during each cycle before it builds up appreciably, thereby limiting transit time and increasing the maximum frequency of oscillation. Derived from limited space-charge accumulation diode. { 'el,es,ā 'di,ōd }

LSB See least significant bit.

L scan See L scope. { 'el ,skān }

L scope [ELECTR] A cathode-ray scope on which a trace appears as a vertical or horizontal range scale, the signals appearing as left and right horizontal (or up and down vertical) deflections as echoes are received by two antennas, the left and right (or up and down) deflections being proportional to the strength of the echoes received by the two antennas. Also known as L indicator; L scan. { 'el ,skōp }

LS coupling See Russell-Saunders coupling. { 'el,es ,kōp-ling }

LSD See dock landing ship; lysergic acid diethylamide.

LSD-25 See lysergic acid diethylamide.

L shell [ATOM PHYS] The second shell of electrons surround-

ing the nucleus of an atom, having electrons whose principal quantum number is 2. { 'el ,shel }

LSI circuit See large-scale integrated circuit. { 'el,es'ī ,sār-kāt }

L-1 test [ENG] A 480-hour engine test in a single-cylinder Caterpillar diesel engine to determine the detergency of heavy-duty lubricating oils. { 'el 'wān ,test }

L-2 test [ENG] An engine test made in a single-cylinder Caterpillar diesel engine to determine the oiliness of an engine oil. Also known as scoring test. { 'el 'tū ,test }

L-3 test [ENG] An engine test in a four-cylinder Caterpillar engine to determine stability of crankcase oil at high temperatures and under severe operating conditions. { 'el 'thrē ,test }

L-4 test [ENG] An engine test in a six-cylinder spark-ignition Chevrolet engine to evaluate crankcase oil oxidation stability, bearing corrosion, and engine deposits. { 'el 'fōr ,test }

L-5 test [ENG] An engine test in a General Motors diesel engine to determine detergency, corrosiveness, ring sticking, and oxidation stability properties of lubricating oils. { 'el 'fīv ,test }

LTPD See lot tolerance percent defective.

LTRS See letters shift.

Lu See lutetium.

lub See least upper bound.

rubber line See rubber's line. { 'lāb-ər ,lin }

rubber's line [NAV] A reference line on any direction-indicating instrument, marking the reading which coincides with the heading. Also known as rubber line; rubber's point. { 'lāb-ər'z ,lin }

rubber's line error [NAV] In a magnetic compass, the angular difference between the heading as indicated by a rubber's line, and the actual heading; this error is caused by faulty calibration. { 'lāb-ər'z ,lin ,erər }

rubber's point See rubber's line. { 'lāb-ər'z ,pōint }

lube cut [MATER] The distilled fraction of crude oil with suitable boiling range and viscosity to yield a lubricating oil when it is completely refined. Also known as lube-oil distillate; lube stock. { 'lüb ,kāt }

lube oil See lubricating oil. { 'lüb ,ōil }

lube-oil distillate See lube cut. { 'lüb ,ōil 'dis-tə,āt }

lube stock See lube cut. { 'lüb ,stāk }

lubricant [MATER] A substance used to reduce friction between parts or objects in relative motion. { 'lüb-rä-kānt }

lubricant additive [MATER] Any material added to lubricants (greases or oils) to give the product special properties, such as resistance to extremes of pressure, cold, or heat, improved viscosity, and detergency. { 'lüb-rä-kānt ,ad-ād-iv }

lubricated gasoline [MATER] A motor gasoline into which a lubricant has been added. { 'lüb-rä,kād-ēd 'gas-ə,lēn }

lubricating film [MATER] A thin layer of oil or grease applied between rubbing surfaces. { 'lüb-rä,kād-ēj ,fīlm }

lubricating grease [MATER] A solid or semisolid lubricant consisting of a thickening agent (soap or other additives) in a fluid lubricant (usually petroleum lubricating oil). { 'lüb-rä,kād-ēj ,grēs }

lubricating oil [MATER] Selected fractions of refined petroleum or other oils (with or without additives) used to lessen friction between moving surfaces. Also known as lube oil. { 'lüb-rä,kād-ēj ,ōil }

lubrication action [MATER] The ability of the lubricant to maintain a fluid film between solid surfaces and to prevent their physical contact. { 'lüb-rä,kāshən ,ak-shən }

lubricator [ENG] A device for applying a lubricant. { 'lüb-rä,kād-ər }

lubricity [MATER] The ability of a material to lubricate. { 'lüb-ris-tē-dē }

Lucanidae [INV ZOO] The stag beetles, a cosmopolitan family of coleopteran insects in the superfamily Scarabaeoidea. { 'lū'kan-ā,dē }

lucca oil See olive oil. { 'lū'ka ,ōil }

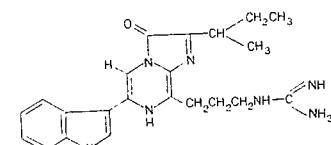
lucerne See alfalfa. { 'lū'sərn }

Lucibacterium [MICROBIO] A genus of light-emitting bacteria in the family Vibrionaceae; motile, asporogenous rods with peritrichous flagella. { 'lū,sī,bak'tir-ē-əm }

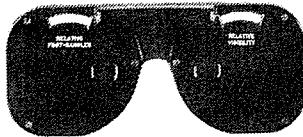
luciferase [BIOCHEM] An enzyme that catalyzes the oxidation of luciferin. { 'lū,sīf-ə,rās }

luciferin [BIOCHEM] A species-specific pigment in many luminous organisms that emits heatless light when combined with oxygen. { 'lū,sīf-ə,rēn }

LUCIFERIN

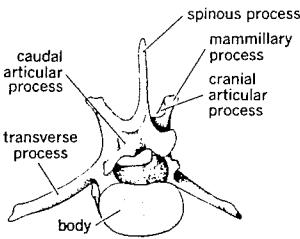


Structural formula of *Cypridina* luciferin.

LUCKIESH-MOSS
VISIBILITY METER

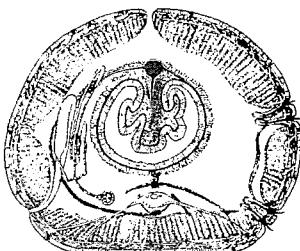
Photograph of Luckiesh-Moss visibility meter. (General Electric Co.)

LUMBAR VERTEBRAE



Fifth lumbar vertebra of the dog, the caudal lateral aspect showing the body or centrum. (From M. E. Miller, G. C. Christensen, and H. E. Evans, *Anatomy of the Dog*, Saunders, 1964)

LUMBRICUS



Cross section of the earthworm (*Lumbricus terrestris*). (From T. I. Storer, *General Zoology*, 3d ed., McGraw-Hill, 1957)

Luciocephalidae [VERT ZOO] A family of fresh-water fishes in the suborder Anabantoidei. { ,lüt'sē-ō-sä'fäl-ə-dē }

Luckiesh-Moss visibility meter [ENG] A type of photometer that consists of two variable-density filters (one for each eye) that are adjusted so that an object seen through them is just barely discernible; the reduction in visibility produced by the filters is read on a scale of relative visibility related to a standard task. { lü'kēsh 'mös',viz'ə-bil'ədē ,mēd'ər }

Lüders' lines [MET] Surface markings on a metal caused by flow of the material strained beyond its elastic limit. Also known as deformation bands; Hartmann lines; Lüders' bands; Piobert lines; stretcher strains. { 'lüd'ərз ,linz }

Ludian [GEOL] A European stage of geologic time in the uppermost Eocene, above the Bartonian and below the Tongrian of the Oligocene. { 'lü-dē-ən }

ludlamite [MINERAL] $(\text{Fe},\text{Mg},\text{Mn})_3(\text{PO}_4)_2 \cdot 4\text{H}_2\text{O}$ A green mineral crystallizing in the monoclinic system and occurring in small, transparent crystals. { 'lēd'lə-mīt }

Ludlovian [GEOL] A European stage of geologic time; Upper Silurian, below Gedinnian of Devonian, above Wenlockian. { 'lēd'lō-vē-ən }

Ludwigite [MINERAL] $(\text{Mg},\text{Fe})_2\text{FeBO}_3$ Blackish-green mineral that crystallizes in the monoclinic system and occurs in fibrous masses; isomorphous with ronzenite. { 'lēd,wig'}

Ludwig's angina [MED] Acute streptococcal cellulitis of the floor of the mouth. { 'lēd,wig'z 'an-jē-nə }

Luenberger observer [CONT SYS] A compensator driven by both the inputs and measurable outputs of a control system. { 'lēn,bär-gər əb'zər-vər }

lueneburgite [MINERAL] $\text{Mg}_3\text{B}_2(\text{OH})_6(\text{PO}_4)_2 \cdot 6\text{H}_2\text{O}$ A colorless mineral composed of hydrous basic phosphate of magnesium and boron. { 'lē-nō-bär,git }

lueshite [MINERAL] NaNbO_3 An orthorhombic mineral having perovskite-type structure; it is dimorphous with natroniobite. { 'lē-as,hit' }

lug [DES ENG] A projection or head on a metal part to serve as a cap, handle, support, or fitting connection. { lag' }

luganot [METEOROL] A strong south or south-southeast wind of Lake Garda, Italy. { lü'gä,nöt' }

lug bolt [DES ENG] 1. A bolt with a flat extension or hook instead of a head. 2. A bolt designed for securing a lug. { 'lēg ,bōlt' }

lug brick [MATER] A brick with lugs for spacing adjacent bricks. { 'lēg ,brik' }

Luggin probe [PHYS CHEM] A device which transmits a significant current density on the surface of an electrode to measure its potential. { 'lēg'ən ,prōb' }

Lugol solution [CHEM] A solution of 5 grams of iodine and 10 grams of potassium iodide per 100 milliliters of water; used in medicine. { 'lē,gōl sə'lür-shən' }

LUHF See lowest useful high frequency.

Luidiidae [INV ZOO] A family of echinoderms in the suborder Paxillosina. { lü'ē-dē-ə,dē }

Lulisan [GEOL] A North American stage of geologic time: Miocene (above Relizian, below Mohnian). { 'lē-ē'shən' }

Lukasiewicz notation See Polish notation. { lü,käsh'ē-ä,vits nō,tā-shən' }

lum See trolley. { ləm' }

lumbago [MED] Backache in the lumbar or lumbosacral region. { ,lēm'bä,gō' }

lumbang oil [MATER] Colorless or yellow liquid with pleasant aroma and bland taste; soluble in alcohol, ether, chloroform, and carbon disulfide; expressed from candlenut; used as an illuminant and wood preservative, and in paints, calking, and soap manufacture. Also known as candlenut oil. { lēm'bäñ ,ōil' }

lumbar artery [ANAT] Any of the four or five pairs of branches of the abdominal aorta opposite the lumbar region of the spine; supplies blood to loin muscles, skin on the sides of the abdomen, and the spinal cord. { 'lēm,bär 'ärd-ə-rē' }

lumbar nerve [ANAT] Any of five pairs of nerves arising from lumbar segments of the spinal cord; characterized by motor, visceral sensory, somatic sensory, and sympathetic components; they innervate the skin and deep muscles of the lower back and the lumbar plexus. { 'lēm,bär 'nōr' }

lumbar vertebrae [ANAT] Those vertebrae located between the lowest ribs and the pelvic girdle in all vertebrates. { 'lēm,bär 'vōrd-ə,brā' }

lumber [MATER] Logs that have been sawed and prepared for market. { 'lēm-bər' }

lumberg [OPTICS] A unit of luminous energy equal to the luminous energy corresponding to a radiant energy of $1/K$ ergs, where K is the luminous efficiency in lumens per watt. Formerly known as lumerg. { 'lēm,bärg' }

lumbodorsal fascia [ANAT] The sheath of the erector spinae muscle alone, or the sheaths of the erector spinae and the quadratus lumborum muscles. { 'lēm'bō'dōr-səl 'făshə' }

lumbosacral plexus [ANAT] A network formed by the anterior branches of lumbar, sacral, and coccygeal nerves which for descriptive purposes are divided into the lumbar, sacral, and pudendal plexuses. { 'lēm'bō'sak-rəl 'plek-səs' }

Lumbriidae [INV ZOO] A family of annelid worms in the order Oligochaeta; includes the earthworm. { 'lēm'bri-sə,dē' }

Lumbriclymeninae [INV ZOO] A subfamily of mud-swallowing sedentary worms in the family Maldanidae. { 'lēm'bri-klī'mē-nə-nē' }

Lumbriellidae [INV ZOO] A family of aquatic annelids in the order Oligochaeta. { 'lēm'bri'kyü-lə,dē' }

Lumbricus [INV ZOO] A genus of earthworms recognized as the type genus of the family Lumbricidae. { 'lēm'bri-kəs' }

Lumbrineridae [INV ZOO] A family of errant polychaetes in the superfamily Eunicea. { 'lēm'bri'ner-ə,dē' }

tumen [ANAT] The interior space within a tubular structure, such as within a blood vessel, a duct, or the intestine. [OPTICS] The unit of luminous flux, equal to the luminous flux emitted within a unit solid angle (1 steradian) from a point source having a uniform intensity of 1 candela, or to the luminous flux received on a unit surface, all points of which are at a unit distance from such a source. Symbolized lm. [SCI TECH] The space within a tube. { 'lēm'ən' }

tumen-hour [OPTICS] A unit of quantity of light (luminous energy), equal to the quantity of light radiated or received for a period of 1 hour by a flux of 1 lumen. Abbreviated lm-hr. { 'lēm-mən 'aür' }

tumen per watt [OPTICS] The unit of luminosity factor and of luminous efficacy. Abbreviated lm/w. { 'lēm-mən pər'wät' }

tumen-second [OPTICS] A unit of quantity of light (luminous energy), equal to the quantity of light radiated or received for a period of 1 second by a flux of 1 lumen. Abbreviated lm-sec. { 'lēm-mən 'sek-ənd' }

lumerg See lumberg. { 'lēm,märg' }

luminaire [ELEC] An electric lighting fixture, wall bracket, portable lamp, or other complete lighting unit designed to contain one or more electric lighting sources and associated reflectors, refractors, housings, and such support for those items as necessary. { 'lēm'mä-nēr' }

luminance [OPTICS] The ratio of the luminous intensity in a given direction of an infinitesimal element of a surface containing the point under consideration, to the orthogonally projected area of the element on a plane perpendicular to the given direction. Formerly known as brightness. { 'lēm'ə-nəns' }

luminance carrier See picture carrier. { 'lēm-mə-nəns ,kar-ər' }

luminance channel [COMMUN] A path intended primarily for the luminance signal in a color television system. { 'lēm-mə-nəns ,chan-əl' }

luminance factor [OPTICS] The ratio of the luminance of a body when illuminated and observed under certain conditions to that of a perfect diffuser under the same conditions. { 'lēm-mə-nəns ,fak-tər' }

luminance primary [COMMUN] One of the three transmission primaries whose amount determines the luminance of a color in a color television system. { 'lēm-mə-nəns ,pri,mer-ē' }

luminance signal [COMMUN] The color television signal that is intended to have exclusive control of the luminance of the picture. Also known as Y signal. { 'lēm-mə-nəns ,sig-nal' }

luminescence [PHYS] Light emission that cannot be attributed merely to the temperature of the emitting body, but results from such causes as chemical reactions at ordinary temperatures, electron bombardment, electromagnetic radiation, and electric fields. { 'lēm-mə'nes-ən' }

luminescent [PHYS] Capable of exhibiting luminescence. { 'lēm-mə'nes-ənt' }

luminescent cell See electroluminescent panel. { 'lēm-mə'nes-ənt'sel' }

luminescent center [SOLID STATE] A point-lattice defect in

luminescent dye

a transparent crystal that exhibits luminescence. { 'lü-mə'nes-ənt 'sēntər }

luminescent dye [MATER] A dye that is made luminous by excitation with an outside energy source; used in luminous paint. { 'lü-mə'nes-ənt 'dī' }

luminescent screen [ELECTR] The screen in a cathode-ray tube, which becomes luminous when bombarded by an electron beam and maintains its luminosity for an appreciable time. { 'lü-mə'nes-ənt 'skrēn' }

luminol [ORG CHEM] $C_8H_7N_3O_2$ A white, water-soluble, crystalline compound that melts at 320°C; used in an alkaline solution for analytical testing in chemistry. Also known as 3-aminophthalic acid cyclic hydrazide. { 'lü-mə,nol' }

luminophor [PHYS] A luminescent material that converts part of the absorbed primary energy into emitted luminescent radiation. Also known as fluophor; fluor; phosphor. { 'lü-min-əfər' }

luminosity [NUCLEO] A measure of the performance of a colliding-beam system, equal to the reaction rate or number of interactions per second divided by the interaction cross section. [OPTICS] See luminosity factor. { 'lü-mə'nä-səd-ē' }

luminosity classes [ASTRON] A classification of stars in an orderly sequence according to their absolute brightness. { 'lü-mə'nä-səd-ē,klas-əz' }

luminosity curve See luminosity function. { 'lü-mə'nä-səd-ē,kərv' }

luminosity factor [OPTICS] The ratio of luminous flux in lumens emitted by a source at a particular wavelength to the corresponding radiant flux in watts at the same wavelength; thus this is a measure of the visual sensitivity of the eye. Also known as luminosity. { 'lü-mə'nä-səd-ē,fak-tər' }

luminosity function [ASTRON] The functional relationship between stellar magnitude and the number and distribution of stars of each magnitude interval. Also known as relative luminosity factor. [OPTICS] A standard measure of the response of an eye to monochromatic light at various wavelengths; the function is normalized to unity at its maximum value. Also known as luminosity curve; spectral luminous efficiency; visibility function. { 'lü-mə'nä-səd-ē,fəng-shən' }

luminosity monitor [NUCLEO] A device, located on the inside of the detector of a colliding-beam accelerator near the two entering beams, that gives a signal proportional to the total number of collisions that occur at the interaction point. { 'lü-mə'nä-səd-ē,mäñ-əd-ər' }

luminous cloud See sheet lightning. { 'lü-mə-nəs'klaud' }

luminous coefficient [OPTICS] A measure of the fraction of the radiant power of a light source which contributes to its luminous properties, equal to the average of the luminosity function at various wavelengths, weighted according to the spectral intensity of the source. Also known as luminous efficiency. { 'lü-mə-nəs,kōñ'fishrənt' }

luminous efficacy [OPTICS] 1. The ratio of the total luminous flux in lumens emitted by a light source over all wavelengths to the total radiant flux in watts. Formerly known as luminous efficiency. 2. The ratio of the total luminous flux emitted by a light source to the power input of the source; expressed in lumens per watt. { 'lü-mə-nəs,ef'ə-kəsē' }

luminous efficiency See luminous coefficient; luminous efficacy. { 'lü-mə-nəs i'fish-əñsē' }

luminous emittance [OPTICS] The emittance of visible radiation weighted to take into account the different response of the human eye to different wavelengths of light; in photometry, luminous emittance is always used as a property of a self-luminous source, and therefore should be distinguished from luminance. Also known as luminous exitance. { 'lü-mə-nəs i'mit'əns' }

luminous energy [OPTICS] The total radiant energy emitted by a source, evaluated according to its capacity to produce visual sensation; measured in lumen-hours or lumen-seconds. { 'lü-mə-nəs 'en-ərjē' }

luminous exitance See luminous emittance. { 'lü-mə-nəs 'ek-səd-əns' }

luminous flux [OPTICS] The time rate of flow of radiant energy, evaluated according to its capacity to produce visual sensations; measured in lumens. { 'lü-mə-nəs 'fləks' }

luminous flux density See illuminance. { 'lü-mə-nəs 'fləks 'den-səd-ē' }

luminous intensity [OPTICS] The luminous flux incident on a small surface which lies in a specified direction from a light

source and is normal to this direction, divided by the solid angle (in steradians) which the surface subtends at the source of light. Also known as light intensity. { 'lü-mə-nəs in'ten-səd-ē' }

luminous mass [ASTRON] The mass of a celestial object inferred from its luminosity or the luminosities of its components. { 'lü-mə-nəs 'mas' }

luminous meteor [METEOROL] According to United States weather observing practice, any one of a number of atmospheric phenomena which appear as luminous patterns in the sky, including halos, coronas, rainbows, aurorae, and their many variations, but excluding lightning (an igneous meteor or electrometeor). { 'lü-mə-nəs 'mēd-ēər' }

luminous nebula [ASTRON] A nebula made bright by radiation from stars in the vicinity. { 'lü-mə-nəs 'neb'yə-lə' }

luminous paint [MATER] A type of paint in which luminous pigments are used. { 'lü-mə-nəs 'pānt' }

luminous pigment [MATER] A pigment that absorbs light energy and radiates visible light when exposed to ultraviolet light; made of phosphors such as strontium, zinc, and cadmium sulfides. { 'lü-mə-nəs 'pig-mənt' }

luminous quantities [OPTICS] Physical quantities used in photometry, such as luminous intensity and luminance, which are based on the response of the human eye, and are thus weighted to take into account the difference in response at different wavelengths of light. { 'lü-mə-nəs 'kwän-əd-ēz' }

luminous range [NAV] The distance at which a marine light may be seen in clear weather, expressed in nautical miles. { 'lü-mə-nəs 'rāñj' }

luminous sensitivity of phototube [ELECTR] Quotient of the anode current by the incident luminous flux. { 'lü-mə-nəs ,sen-sət'iv-əd-ē əv 'fōd-ō,tüb' }

luminous time ratio [NAV] Of a navigational light, the ratio of the length of a flash to the period of rotation. { 'lü-mə-nəs 'tim,rāshō' }

luminous visibility diagram [NAV] A diagram by which the luminous ranges, as given in light lists, may be adjusted to various conditions of visibility. { 'lü-mə-nəs,viz'ə-bil-əd-ē,di-əgram' }

Lummer-Brodhun sight box [OPTICS] A device, having a series of prisms, for viewing simultaneously the two sides of a white diffuse plaster screen illuminated by light sources whose luminous intensities are being compared. { 'lüm'ər 'brōd,hūn 'sīt,bäks' }

Lummer-Gehrcke plate [OPTICS] An interferometer consisting of a glass or quartz plate with parallel surfaces and sizable thickness in which multiple reflections take place. { 'lüm'ər 'gerkə,plāt' }

lump coal [MIN ENG] Bituminous coal that passes through a 6-inch (15-centimeter) round mesh in initial screening. { 'ləmp,kōl' }

lumpectomy [MED] Surgical removal of a tumor in the breast along with a small amount of surrounding tissue. { ləm'pek-tōmē' }

lumped constant [ELEC] A single constant that is electrically equivalent to the total of that type of distributed constant existing in a coil or circuit. Also known as lumped parameter. { 'ləmpt,kāñstənt' }

lumped-constant network [ELEC] An analytical tool in which distributed constants (inductance, capacitance, and resistance) are represented as hypothetical components. { 'ləmpt,kāñstənt'net,wərk' }

lumped discontinuity [ELECTROMAG] An analytical tool in the study of microwave circuits in which the effective values of inductance, capacitance, and resistance representing a discontinuity in a waveguide are shown as discrete components of equivalent value. { 'ləmpt,dis,kāñtəñt'ü-əd-ē' }

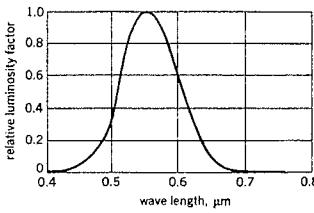
lumped element [ELECTROMAG] A section of a transmission line designed so that electric or magnetic energy is concentrated in it at specified frequencies, and inductance or capacitance may therefore be regarded as concentrated in it, rather than distributed over the length of the line. { 'ləmpt,el'ə-mənt' }

lumped impedance [ELECTROMAG] An impedance concentrated in a single component rather than distributed throughout the length of a transmission line. { 'ləmpt,im'pēd-əns' }

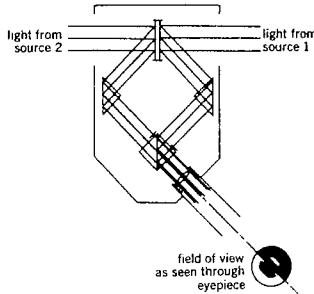
lumped parameter See lumped constant. { 'ləmpt,pə'ram-əd-ər' }

lumper [SYST] A taxonomist who tends to recognize large taxa. { 'ləm'pər' }

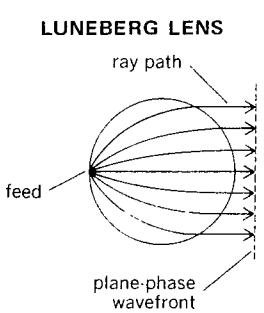
lumpy jaw See actinomycosis. { 'ləm'pē,jō' }

LUMINOSITY FUNCTION

Human-eye luminosity function.
(From W. B. Boast, *Illumination Engineering*, 2d ed., McGraw-Hill, 1953)

LUMMER-BRODHUN SIGHT BOX

Lummer-Brodhun contrast sight box.



Luneberg lens with dielectric sphere between feed and plane-phase wavefront.

Luna [ASTRON] A name for the moon. { 'lü-nə }
lunabase [ASTRON] The basic rocks that make up the dark portions of the lunar surface. Also known as marebase; marial rocks. { 'lü-nə,bās }
Luna program [AERO ENG] A series of Soviet space probes launched for flight missions to the moon. { 'lü-nə ,prō-gram }
lunar appulse [ASTRON] An eclipse of the moon in which the penumbral shadow of the earth falls on the moon. Also known as penumbral eclipse. { 'lü-nər 'a,pəls }
lunar atmosphere [ASTROPHYS] The volatile elements postulated to have been present on the moon's surface at one time. { 'lü-nər 'at-mə,sfīr }
lunar atmospheric tide [METEOROL] An atmospheric tide due to the gravitational attraction of the moon; the only detectable components are the 12-lunar-hour or semidiurnal component, as in the oceanic tides, and two others of very nearly the same period; the amplitude of this atmospheric tide is so small that it is detected only by careful statistical analysis of a long record. { 'lü-nər ,at-mə,sfīr-ik 'tīd }
lunar caustic [MATER] A form of toughened silver nitrate consisting of 97–98% silver nitrate and 2–3% silver chloride. Also known as fused silver nitrate; molded silver nitrate. { 'lün-ər 'kō-stik }
lunar crater [ASTRON] A crater on the moon's surface. { 'lün-ər 'krāt-ər }
lunar crust [ASTRON] The outer layer of the moon. { 'lün-ər 'krast }
lunar day [ASTRON] The time interval between two successive crossings of the meridian by the moon. { 'lün-ər 'dā }
lunar dust [ASTRON] Small particles adhering to the moon's surface. { 'lün-ər 'dəst }
lunar eclipse [ASTRON] Obscuration of the full moon when it passes through the shadow of the earth. { 'lün-ər i'klips }
lunar ephemeris [ASTRON] A computed list of positions the moon will occupy in the sky on certain dates. { 'lün-ər i'fem-ərəs }
lunar excursion module [AERO ENG] A manned spacecraft designed to be carried on top of the Apollo service module and having its own power plant for making a manned landing on the moon and a return from the moon to the orbiting Apollo spacecraft. Abbreviated LEM. Also known as lunar module (LM). { 'lün-ər ik'skər-zhən ,majūl }
lunar flight [AERO ENG] Flight by a spacecraft to the moon. { 'lün-ər 'flīt }
lunar geology See selenology. { 'lün-ər jē'äl-əjē }
lunar inequality [ASTRON] Variation in the moon's motion in its orbit, due to attraction by other bodies of the solar system. [GEOPHYS] A minute fluctuation of a magnetic needle from its mean position, caused by the moon. { 'lün-ər ,in'ikwäl-ədē }
lunar interval [ASTRON] The difference in time between the transit of the moon over the Greenwich meridian and a local meridian; the lunar interval equals the difference between the Greenwich and local intervals of a tide or current phase. { 'lün-ər 'int'vəl }
lunarite [ASTRON] The rocks that make up the bright portions of the lunar surface. { 'lün-ər ,īt }
lunar libration [ASTRON] 1. The effect wherein the face of the moon appears to swing east and west about 8° from its central position each month. Also known as apparent libration in longitude. 2. The state wherein the inclination of the moon's polar axis allows an observer on earth to see about 59% of the moon's surface. Also known as libration in latitude. 3. The small oscillation with which the moon rocks back and forth about its mean rotation rate. Also known as physical libration of the moon. { 'lün-ər lī'brāshən }
lunar magnetic field [ASTROPHYS] The magnetic field of the moon. { 'lün-ər mag'ned-ik 'fēld }
lunar mass [ASTROPHYS] The mass of the moon. { 'lün-ər 'mas }
lunar meteoroid [ASTRON] A meteoric particle before it strikes the moon. { 'lün-ər 'mēd-ē-ə,rōid }
lunar module See lunar excursion module. { 'lün-ər 'mäjūl }
lunar month [ASTRON] The period of revolution of the moon about the earth, especially a synodical month. { 'lün-ər 'mənθ }
lunar mountain [ASTRON] A mountain on the moon. { 'lün-ər 'maūntən }
lunar node [ASTRON] A node of the moon's orbit. { 'lün-ər 'nōd }

lunar nodule [ASTRON] A rock nodule found on the moon. { 'lün-ər 'nōd-yüł }
lunar noon [ASTRON] The instant at which the sun is over the upper branch of any meridian of the moon. { 'lün-ər 'nün }
lunar nutation [ASTRON] A nodding motion of the earth's axis caused by the inclination of the moon's orbit to the ecliptic; it can displace the celestial pole by 9 seconds of arc from its mean position and has a period of 18.6 years. { 'lün-ər nü'tāshən }
lunar orbit [AERO ENG] Orbit of a spacecraft around the moon. { 'lün-ər 'örbēt }
lunar polarization [ASTROPHYS] Polarization of light by the moon's surface. { 'lün-ər ,pō-lərā'zāshən }
lunar pole [ASTRON] A pole of the moon. { 'lün-ər 'pōl }
lunar probe [AERO ENG] Any space probe launched for flight missions to the moon. { 'lün-ər 'prōb }
lunar rainbow See moonbow. { 'lün-ər 'rān,bō }
lunar rock [ASTRON] Rock found on the moon. { 'lün-ər 'rāk }
lunar satellite [AERO ENG] A satellite making one or more revolutions about the moon. { 'lün-ər 'sat-ə,slīt }
lunar spacecraft [AERO ENG] A spacecraft designed for flight to the moon. { 'lün-ər 'spās,kraft }
lunar tide [OCEANOGR] The portion of a tide produced by forces of the moon. { 'lün-ər 'tīd }
lunar time [ASTRON] 1. Time based upon the rotation of the earth relative to the moon; it may be designated as local or Greenwich, as the local or Greenwich meridian is used as the reference. 2. Time on the moon. { 'lün-ər 'tīm }
lunar topology [ASTRON] Topology of the moon. { 'lün-ər tō-pol'əjē }
lunar year [ASTRON] A time interval comprising 12 lunar (synodic) months. { 'lün-ər 'yir }
lunate [BIOL] Crescent-shaped. { 'lün,ət }
lunate bar [GEOL] A crescent-shaped bar of sand that is frequently found off the entrance to a harbor. { 'lün,ət 'bär }
lunation [ASTRON] The time period between two successive new moons. { lün'āshən }
Lundegardh vaporizer [ANALY CHEM] A device used for emission flame photometry in which a compressed air aspirator vaporizes the solution within a chamber; smaller droplets are carried into the fuel-gas stream and to the burner orifice where the solvent is evaporated, dissociated, and optically excited. { 'lün-də,gard 'vā-pō,rīz-ər }
lune [MATH] A section of a plane bounded by two circular arcs, or of a sphere bounded by two great circles. { lün }
Luneberg lens [ELECTROMAG] A type of antenna consisting of a dielectric sphere whose index of refraction varies with distance from the center of the sphere so that a beam of parallel rays falling on the lens is focused at a point on the lens surface diametrically opposite from the direction of incidence, and, conversely, energy emanating from a point on the surface is focused into a plane wave. Accurately spelled Luneburg lens. { 'lün-nə,bərg ,lēns }
Luneburg lens See Luneberg lens. { 'lün-nə,bərg ,lēns }
lunette [GEOL] A broad, low crescentic mound of windblown fine silt and clay. [ORD] Towing ring in the trial plate or tongue of a towed vehicle, such as a gun carriage or trailer, used for attaching the towed vehicle to the prime mover or towing vehicle. { lün'et }
lung [ANAT] Either of the paired air-filled sacs, usually in the anterior or anteroventral part of the trunk of most tetrapods, which function as organs of respiration. { ləng }
lung bud [EMBRYO] A primary outgrowth of the embryonic trachea; the anlage of a primary bronchus and all its branches. { 'ləng ,bəd }
lungfish [VERT ZOO] The common name for members of the Diplopodi; all have lungs that arise from a ventral connection with the gut. { 'ləng,fish }
lung-governed breathing apparatus [ENG] A breathing apparatus in which the oxygen that is supplied to the wearer is governed by the wearer's demand. { 'ləng ,gav-ərnd 'brēth-ing ap-pa,rəd-əs }
lungworm [INV ZOO] Any of the nematodes that are parasites of terrestrial and marine nematodes, most commonly found in the respiratory tract, characterized by a reduced or absent stoma capsule, and an oral opening surrounded by six well-developed lips. { 'ləng,wərm }
lunisolar precession [ASTROPHYS] Precession of the earth's